



The association between the receipt of primary care clinician provision of preventive care and short term health behaviour change

Kate Bartlem^{a,b,*}, Luke Wolfenden^{b,c}, Kim Colyvas^d, Libby Campbell^{b,c}, Megan Freund^c, Emma Doherty^{b,c}, Carolyn Slattery^b, Danika Tremain^{b,c}, Jenny Bowman^a, John Wiggers^{b,c}

^a School of Psychology, University of Newcastle, Callaghan, Australia

^b Hunter New England Population Health, Wallsend, Australia

^c School of Medicine and Public Health, University of Newcastle, Callaghan, Australia

^d School of Mathematical and Physical Sciences, University of Newcastle, Callaghan, Australia

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ABSTRACT

Primary healthcare services are recommended to provide preventive care to address chronic disease risk behaviours. However, all care elements are infrequently provided, and there is a need to understand the impact of partial care provision on behaviour change. This study examined the association between variable levels of preventive care receipt from primary care clinicians on short-term behaviour change for four risk behaviours. A survey was undertaken with 5639 Australian community health service clients (2009–2014). Clients self-reported: engagement in risk behaviours (tobacco smoking, harmful alcohol consumption, inadequate fruit and/or vegetable consumption, physical inactivity) in the month prior to and four week post their community health service appointment; receipt of preventive care during appointments (assessment, advice, referral/follow-up) for each behaviour. Univariate regression models explored the association between change in risk status and preventive care received. The odds of behaviour change for those receiving all three care elements was significant for all behaviours, compared to no care, ranging from 2.02 (alcohol consumption, 95% CI 1.16–3.49) to 4.17 (inadequate fruit and/or vegetable consumption, 95% CI 2.91–5.96). Receipt of both assessment and advice increased the odds of behaviour change, compared to no care, for all behaviours except smoking, ranging from 2.32 (physical inactivity, 95% CI 1.60–3.35) to 2.83 (alcohol consumption, 95% CI 1.84–4.33). Receipt of ‘assessment only’ increased the odds of behaviour change, compared to no care, for inadequate fruit and/or vegetable consumption (OR = 2.40, 95% CI 1.60–3.59) and physical inactivity (OR = 2.81, 95% CI 1.89–4.17). Results highlight the importance of primary care clinicians providing best practice preventive care to maximise client behaviour change.

1. Introduction

Chronic non-communicable diseases account for the greatest proportion of morbidity and mortality worldwide, responsible for 72.3% of global mortality in 2016 (Naghavi et al., 2017). Among high-income countries in 2016, ischaemic heart disease, cerebrovascular disease, cardiopulmonary disease, and lung, colorectal and breast cancers were all ranked within the top ten causes of mortality (Naghavi et al., 2017). Behavioural risk factors were the largest contributor to all-cause mortality, accounting for 32.7% of attributed disability adjusted life years (Gakidou et al., 2017). Among such behavioural risks, tobacco smoking, alcohol consumption, dietary habits and physical inactivity are key contributors to chronic disease (Gakidou et al., 2017; AIHW, 2016; Lee

et al., 2012; Lock et al., 2005).

One strategy for reducing the chronic disease burden is the routine provision of care targeting modifiable behavioural risks (preventive care) by primary care clinicians (Harris and Lloyd, 2012; Goldstein et al., 2004; Royal Australian College of General Practitioners, 2009; US Department of Health and Human Services, 2009). A widely recommended model of preventive care is the ‘5As’ framework (Harris and Lloyd, 2012; Glasgow et al., 2004; Coups et al., 2004; Carroll et al., 2012; Whitlock et al., 2002), where clinicians provide care in five steps: ask, advise, assess, assist, and arrange/follow-up (Harris and Lloyd, 2012; Glasgow et al., 2004; Coups et al., 2004). Developed to guide the provision of smoking cessation interventions (Glasgow et al., 2004; Coups et al., 2004), the 5As model has been successfully applied to

* Corresponding author at: School of Psychology, University of Newcastle, Callaghan, Australia.

E-mail address: Kate.Bartlem@newcastle.edu.au (K. Bartlem).

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other behaviours such as diet, alcohol consumption, and physical activity (Ockene et al., 1995; Ockene et al., 1997; Pinto et al., 2005; Harrison et al., 2012), and is consistently reported to be effective in reducing health risk behaviours (Harris and Lloyd, 2012; Goldstein et al., 2004; Whitlock et al., 2002; Pinto et al., 2005; Harrison et al., 2012; Fiore et al., 2008). However, competing clinical priorities, large clinical loads and time constraints are frequently reported as barriers for the delivery of preventive care (Ministry of Health, 2007; Revell and Schroeder, 2005), and it is often not delivered opportunistically as recommended (Royal Australian College of General Practitioners, 2009; US Department of Health and Human Services, 2009; National Institute for Health and Care Excellence, 2011; National Institute for Health and Care Excellence, 2013; National Institute for Health and Care Excellence, 2014; National Institute for Health and Care Excellence, 2018; National Preventive Health Taskforce, 2010). Accordingly, a condensed model of the 5As framework, the 'AAR' has been recommended (assess, advice, refer) (Schroeder, 2005; Schroeder and Morris, 2010; Vidrine et al., 2013) and has been demonstrated to be equally as effective for smoking (Gordon et al., 2010; Yaya et al., 2018). Despite the simplicity of the reduced AAR model, research suggests that barriers like those reported for the delivery of the 5As, limit its routine provision (McElwaine et al., 2013; McElwaine et al., 2014a; Bartlem et al., 2015; Bartlem et al., 2014; Tremain et al., 2016; Zeev et al., 2017). Consequently, incomplete care frequently occurs, with many clinicians providing assessment of risk behaviours, but failing to provide further behaviour change support e.g. advice and referral/follow-up (McElwaine et al., 2013; McElwaine et al., 2014a; Bartlem et al., 2015; Bartlem et al., 2014; Tremain et al., 2016; Zeev et al., 2017).

Research exploring the effectiveness of the different care components of the 5As or AAR models has primarily focused on smoking cessation (Gordon et al., 2010; Gordon et al., 2007; Park et al., 2015). Some evidence suggests that full implementation of the 5As model may lead to more successful behaviour change than partial implementation (Gordon et al., 2007), while other research has suggested that key care elements may be more important (Gordon et al., 2010; Park et al., 2015; Whitlock et al., 2004). For instance, a 2015 study in the US explored the association between receipt of the 5As and smoking cessation behaviours of over 3000 smokers who had seen a primary care provider in the previous 6 months. Receipt of 'ask', 'advise' or 'assess' were not associated with quitting smoking; however participants who reported having received 'assist' or 'arrange' had 40% and 60% increased odds of having quit smoking at 12 months respectively, compared to those who had not (Park et al., 2015).

An understanding of the impact of partial provision of the AAR model is required, particularly for behaviours other than smoking, to assess the potential benefit of the provision of only some elements of care, and to identify which elements are associated with a change in health risk behaviour. This study aimed to assess the association between the receipt of elements of the AAR model from primary care clinicians (no care; assessment only; assessment and advice; assessment, advice and referral/follow-up), on short term behaviour change (approximately one month) for key health risk behaviours (tobacco smoking, harmful alcohol consumption, inadequate fruit and/or vegetable consumption, inadequate physical activity).

2. Methods

2.1. Study design and setting

A survey was undertaken with clients of 56 community healthcare facilities in one health district in New South Wales, Australia. In Australia, publicly funded community health services are the second largest provider of health care after general practitioners, and employ a range of nurses and allied health clinicians (New South Wales Health, 2014; Owen et al., 2008; Australian Government PC, 2018). Data were collected over 56 months (October 2009–May 2014) via telephone

interviews. The study was undertaken in the context of a clinical practice change trial that aimed to increase clinician provision of preventive care (Wiggers et al., 2017). All services were subject to a district wide policy that mandated the routine provision of preventive care following the AAR model for tobacco smoking, harmful alcohol consumption, inadequate fruit and/or vegetable consumption and inadequate physical activity, as a population approach to identifying and addressing these health risk behaviours, regardless of service type or professional discipline. Ethical approval was obtained from the Hunter New England Human Research Ethics Committee (approval No. 09/06/17/4.03) and University of Newcastle Human Research Ethics Committee (approval No. H-2010-1116).

2.2. Sample

Eligible services were community health facilities that provided any of the following to adult clients: nursing (aged care; counselling, dietetics, psychology, physiotherapy and occupational therapist services). Clients could participate in data collection if they: had at least one face to face visit to an eligible community health service within the prior two weeks, were 18 years of age or older, spoke English, were mentally and physically capable of completing a telephone interview upon contact, had not previously participated; were not involved in another community health care focused study; were not living in aged care facilities or gaol, and were not considered by their clinician to be inappropriate to be contacted; for instance considered too unwell, or where contact may pose a risk to the client (e.g. domestic violence).

2.3. Recruitment

A sample of approximately 60 adult clients (powered to address the aims of the larger trial) were randomly selected from electronic service records each week by an independent statistician using the survey select procedure in SAS v9.3. Potential participants were mailed an information letter, and those who did not opt out were telephoned by trained interviewers approximately two weeks later to confirm eligibility and complete an interview. A maximum of 10 call attempts were made over a two week period, with successful interviews completed between three to five weeks following their appointment.

2.4. Data collection and measures

Data were collected via structured computer-assisted telephone interviews (approximately 25 min long) by trained interviewers. Additional client and service characteristics were extracted from participating clients' electronic medical records.

2.4.1. Client characteristics

Socio-demographic data collected via interview included employment status, Aboriginal and/or Torres Strait Islander status, marital status, and level of education. Data obtained through electronic medical records included age, gender, postcode, service type, and number of community health appointments in the last 12 months.

2.4.2. Client risk status

2.4.2.1. Pre-consultation risk: in the month prior to seeing the community health service. During the interview participants were asked to report their engagement in health risk behaviours during the month prior to seeing the community health service. Using validated items from recommended risk identification survey tools (Heatherton et al., 1991; Marshall et al., 2008; Babor et al., 2001; Australian Bureau of Statistics, 1997), clients reported: if they smoked any tobacco products; number of serves of fruit and of vegetables usually eaten per day; frequency of alcohol consumption and number of standard drinks of alcohol consumed on a typical drinking day; how often four or more standard drinks of alcohol were consumed on a single occasion; and

how many days a week they usually undertook 30 min or more of physical activity.

In line with Australian national guidelines (National Health and Medical Research Council, 2009; Department of Health, 2014; Department of Health and Ageing, 2013; Intergovernmental Committee on Drugs, 2012), client risk status was defined as: smoking any tobacco products (Intergovernmental Committee on Drugs, 2012), eating less than two serves of fruit or less than five serves of vegetables per day (Department of Health and Ageing, 2013), drinking more than two standard drinks a day or four or more standard drinks on any one occasion (National Health and Medical Research Council, 2009), or engaging in less than 30 min of physical activity on at least five days of the week (Department of Health, 2014).

2.4.2.2. Post-consultation risk: risk status approximately one month after appointment. Clients who were classified according to Australian national guidelines (National Health and Medical Research Council, 2009; Department of Health, 2014; Department of Health and Ageing, 2013; Intergovernmental Committee on Drugs, 2012) as being at risk for one or more behaviours at pre-consultation, were asked to report their current engagement in those behaviours, using the same items.

2.4.3. Client receipt of preventive care

Items regarding client receipt of care were developed specifically for the larger trial.

2.4.3.1. Assessment. All clients were asked whether, during their community health appointments, their clinician assessed: if they smoked any tobacco products; how many serves of fruit and serves of vegetables they ate; how much alcohol they usually consumed; and how much physical activity they undertook (yes, no, don't know).

2.4.3.2. Advice. Clients who were identified as having behavioural risks in the month prior to their community health appointment(s) were asked to report whether the clinician had provided brief advice for each of their risks. Clients were asked whether their clinician advised them to: quit smoking or consider nicotine replacement therapy; eat more servings of fruit or eat more vegetables; reduce their alcohol consumption, or to do more physical activity (yes, no, don't know).

2.4.3.3. Referral/follow-up. For each of their behavioural risks, clients were asked whether the clinician: told them about or offered to arrange a referral to the NSW Quitline phone service (for smoking) or the NSW Get Healthy Information and Coaching phone service (for inadequate fruit or vegetable intake and/or inadequate physical activity); or recommended a visit to their general practitioner/Aboriginal Medical Service or other professional sources of support (e.g. dietician) (yes, no, don't know).

2.5. Data analysis

Data were analysed using SAS V9.4. Participant socioeconomic disadvantage (Australian Bureau of Statistics, 2008) and geographic remoteness (Department of Health and Aged Care, 2001) were calculated based on participant postcode. Chi-squared analyses were used to examine any differences between participants and eligible non-consenters for age, gender, remoteness, disadvantage, and number of appointments in the previous 12 months. Dichotomous risk variables were calculated for each behaviour (Yes/No). Overall fruit and/or vegetable risk variables were calculated by combining responses to fruit intake and vegetable intake questions. For each behaviour, a variable was created to indicate change in risk status from being 'at-risk' pre-consultation, to being 'not at risk' post-consultation.

All analyses of the receipt of preventive care for each behaviour were restricted to participants who were at risk pre-consultation. For each element of preventive care (assessment, advice, referral/follow-

up) for each of the four behaviours, client report of receipt of care was dichotomised (yes vs no/don't know/missing). For each behaviour, a variable was created to reflect receipt of referral/follow-up, including any of the following: being told about or receiving an offer to arrange a referral to the relevant telephone service, or recommended a visit to general practitioner/Aboriginal Medical Service, or other professional source of support. For each behaviour, a variable was calculated to reflect the combination of preventive care that clients reported receiving: no care; assessment only; assessment and advice only; assessment and advice and referral/follow-up. Remaining care combinations (advice and referral; advice only; referral/follow-up only; assessment and referral/follow-up) are reported descriptively, but not included in association analyses due to small numbers.

Descriptive statistics were used to examine sample characteristics; the proportions of participants at risk pre-consultation, and of those, the proportion who reported a change in risk status from pre to post consultation (no longer at risk post-consultation); and the proportions who received each combination of care. The association between change in reported risk status from being 'at risk' pre-consultation to no longer being at risk post-consultation, and preventive care received (no care; assessment only; assessment and advice; assessment advice and referral/follow-up) was carried out using univariate logistic regression. Four models were undertaken (one model for each risk behaviour). Significant effects were examined using all pairwise comparisons between the four types of preventive care received (no care; assessment only; assessment and advice; assessment advice and referral). Eight potential demographic/clinical covariates (gender, age, socioeconomic disadvantage, geographic remoteness, Aboriginal and Torres Strait Islander status, marital status, education level and number of community health appointments in the last 12 months) were tested for inclusion in each model. Backwards elimination models with all eight potential covariates were undertaken, with the significance level of covariates set at $p = .006$ due to increased likelihood of significant associations without pre-specified hypotheses (Bonferroni adjustment: 0.05/8 covariates) (Perneger, 1998). Significant covariates were retained in the model, and additional modelling was undertaken to test for interactions between any significant covariates and the key explanatory variable. Final models are based on the adjusted estimates for the explanatory variable (preventive care received), accounting for any significant covariates.

3. Results

3.1. Sample description

A total of 9507 clients were selected for participation across the study period. Of these, 8512 (90%) were able to be contacted by phone, with 6845 (80%) identified upon contact as being eligible for participation. Of these, 5639 completed data collection (82%). Approximately 40% were male, three quarters were aged 55 years or older, and a large proportion of participants were retired (58.7%) (Table 1). No differences were found between consenters and eligible non-consenters for gender, remoteness or disadvantage. Compared to eligible non-consenters, participants were less likely to be aged 55 years or more (81.2%; vs 18–34 years 84.1% or 35–54 years 87.2%; $p < .0001$), and more likely to have seen the service just once in the last 12 months (84.6%; compared to two or more appointments 81.8%; $p = .01$).

3.2. Pre-consultation risk

Prior to appointments with their community health service, 82.5% of the sample was at risk for at least one behaviour (Table 2, footnoted). The majority of participants were at risk for inadequate fruit and/or vegetable consumption (71.7%), with around a quarter at risk for inadequate physical activity (23.6%) and harmful alcohol consumption (23.0%). Fewer were current smokers (13.7%; Table 2).

Table 1
Demographic description of sample (N = 5639).

Characteristic	%	n
Male	40.3%	2272
Age		
18–34	8.5%	479
35–54	16.6%	937
55 +	74.9%	4223
Aboriginal and/or Torres Strait Islander origin	5.5%	308
Marital status ^a		
Married/living together in a relationship	55.3%	3115
Previously or never married	44.7%	2515
Highest educational attainment ^b		
Some high school or less	65.0%	3659
Completed higher school or equivalent TAFE or diploma	8.4%	472
University equivalent or higher	17.8%	1001
University equivalent or higher	8.8%	496
Employment ^c		
Currently employed (full/part-time/casual)	19.6%	1103
Retired	58.7%	3309
Can't work for health reasons	10.7%	605
Other ^d	11.1%	621
Disadvantage ^e		
Lower NSW half	78.1%	4404
Highest NSW half	21.9%	1232
Remoteness ^f		
Major cities	21.3%	1198
Regional/remote	78.7%	4438
Number of appointments in last 12 months ^g		
1	22.5%	1265
2–4	27.1%	1529
5–10	24.2%	1366
11 +	26.2%	1475
Service type ^h		
Aged care	7.7%	435
Allied health	27.5%	1548
Community nursing and other nursing services	38.7%	2178
Other	26.1%	1473

^a Marital status: 9 missing responses.

^b Education: 11 missing responses.

^c Employment: 1 missing response.

^d Other includes: unemployed n = 111, 2.0%; home duties n = 386, 6.9%; student n = 39, 0.7%; or other n = 85, 1.5%.

^e Disadvantage: 3 missing responses.

^f Remoteness: 3 missing responses.

^g Number of appointments: 4 missing responses.

^h Nursing services include: audiology, cardio-rehabilitation, generalist, community, diabetes. Other service types include: rehabilitation, chronic and complex care, women's services, migrant services, renal/dialysis, and regional health service programs.

3.3. Receipt of preventive care

Of those participants who were classified as at risk prior to seeing their community health service, between 17.9% (smoking) and 50.6% (inadequate fruit and/or vegetable consumption) did not receive any preventive care (Table 2). Between 11.0% (smoking) and 35.5% (harmful alcohol consumption) of participants with risks received assessment only; while 13.3% (inadequate fruit and/or vegetable consumption) to 24.4% (smoking) received both assessment and advice. Among smokers, 41.3% received all three elements of care (assessment, advice and referral/follow-up); however, a smaller proportion received all three elements of care for each of the other behaviours (9.5% harmful alcohol consumption; 11.9% inadequate fruit and/or vegetable consumption; 22.6% inadequate physical activity).

3.4. Change in reported risk status

Of those at risk pre-consultation, between 6.4% (inadequate fruit and/or vegetable consumption) and 28.5% (inadequate physical activity) had improved their health behaviours and were no longer

classified as being at risk post-consultation (Table 2). Table 3 presents the proportion of participants who changed their reported risk status from pre-consultation to post-consultation for each behaviour, by the preventive care received.

3.5. Associations between receipt of preventive care and change in reported risk status

Compared to receipt of no preventive care, the receipt of assessment only increased the odds of a reported change in risk status for inadequate fruit and/or vegetable consumption (OR = 2.40, 95% CI 1.60–3.59) and inadequate physical activity (OR = 2.81, 95% CI 1.89–4.17). The receipt of assessment and advice was associated with increased odds of changing risk status when compared to no care, for all behaviours except smoking: alcohol consumption (OR = 2.83, 95% CI 1.84–4.33), inadequate fruit and/or vegetable consumption (OR = 2.57, 95% CI 1.74–3.79), inadequate physical activity (OR = 2.32, 95% CI 1.60–3.35). When compared to the receipt of no preventive care, the odds of changing risk status for those who received the full model of preventive care (assessment, advice, referral/follow-up) was significant for all risk behaviours and ranged from OR = 2.02 (for alcohol consumption, 95% CI 1.16–3.49) to OR = 4.17 (for inadequate fruit and/or vegetable consumption, 95% CI 2.91–5.96; Table 3).

Receipt of the full model of care increased the odds of reported behaviour change when compared to assessment alone for smoking (OR 2.53, 95% CI 1.05–6.12) and inadequate fruit and/or vegetable consumption (OR 1.74; 95% CI 1.14–2.65); and when compared to assessment and advice only for smoking (OR 2.07, 95% CI 1.14–3.75) and inadequate fruit and/or vegetable consumption (OR 1.63, 95% CI 1.08–2.44). The receipt of assessment and advice increased the odds of reported behaviour change compared to assessment alone for those engaging in harmful alcohol consumption (OR = 2.09, 95% CI 1.42–3.09), however the addition of referral did not increase the odds of reported behaviour change (OR = 0.71, 95% CI 0.42–1.21).

4. Discussion

This study found associations between the receipt of the AAR (assessment, advice, referral/follow-up) model of preventive care and reported behaviour change for four key chronic disease health risk behaviours (tobacco smoking, harmful alcohol consumption, inadequate fruit and/or vegetable consumption and inadequate physical activity). The extent of behaviour change varied by risk behaviour and the number and types of elements of care provided. For all behaviours, the receipt of the full model of preventive care had the greatest benefit. The findings support the effectiveness of the brief AAR model of preventive care in supporting health behaviour change, and suggest that any amount of preventive care may be beneficial, though receipt of the full model is most likely to result in positive behaviour change.

The increased odds of reported behaviour change, compared to no care, for clients receiving the full AAR model across all four behaviours is consistent with research demonstrating that full implementation of the 5As model of care is most effective for smoking related behaviour change (Gordon et al., 2007), and that the provision of more intensive elements of care is more likely to result in behaviour change (Gordon et al., 2010; Park et al., 2015; Whitlock et al., 2004). This study extends these findings to other behavioural risks and highlights the importance of ensuring referral/follow-up is provided. Previous studies have used variable definitions of referral/follow-up when examining the impact of different care elements on behaviour change (Gordon et al., 2010; Gordon et al., 2007; Park et al., 2015; Whitlock et al., 2004). The definition of referral/follow-up used in the current study is inclusive, and comprised a number of referral/follow-up avenues. It is unknown whether clients took up the offers of referral or recommendations to seek further support, and future studies should explore whether the

Table 2
Proportions at risk for each behaviour pre-consultation and post-consultation; and preventive care received during community health appointment(s).

	Tobacco smoking		Harmful alcohol consumption		Inadequate fruit and/or vegetable consumption		Inadequate physical activity	
	%	n/N	%	n/N	%	n/N	%	n/N
Risk								
Pre-consultation								
% at risk pre-consultation ^{a,b}	13.7%	770/5639	23.0%	1296/5639	71.7%	4042/5639	23.6%	1328/5639
Post-consultation								
% with reported risk status change (no longer at risk)	11.3%	87/770	15.8%	205/1296	6.4%	260/4042	28.5%	379/1328
Preventive care received^{c,d}								
No care	17.9%	138/770	31.2%	404/1296	50.6%	2045/4042	30.9%	410/1328
Assessment only	11.0%	85/770	35.5%	460/1296	12.3%	496/4042	14.7%	195/1328
Assessment + brief advice	24.4%	188/770	20.4%	264/1296	13.3%	536/4042	20.1%	267/1328
Assessment + brief advice + referral/follow-up ^e	41.3%	318/770	9.5%	123/1296	11.9%	481/4042	22.6%	300/1328
Other care combinations^f								
Assessment and referral/follow-up	0.9%	7/770	2.2%	28/1296	3.5%	141/4042	5.0%	66/1328
Advice and referral/follow-up	0.8%	6/770	0.1%	1/1296	1.5%	61/4042	1.7%	11/1328
Advice only	3.4%	26/770	1.0%	13/1296	4.1%	166/4042	3.7%	49/1328
Referral/follow-up only	0.3%	2/770	0.2%	3/1296	2.9%	116/4042	1.4%	19/1328

^a Missing responses: 1 for alcohol risk; 2 for nutrition risk; 1 for physical activity risk.

^b Number of risks (pre): 0 risks n = 984 (17.5%); 1 risk n = 2513 (44.6%), 2 risks n = 1563 (27.7%), 3 risks n = 507 (9.0%), 4 risks n = 68 (1.2%).

^c Limited to participants at risk for each behaviour.

^d n = 2 missing responses for alcohol referral were considered to reflect not having received a referral for alcohol overconsumption. The missing values were handled by list wise deletion for each analysis.

^e Of those participants who reported receiving referral/follow-up, this included: *Smoking*: Total referral/follow-up: n = 333: advised about the NSW Quitline service n = 298; offered a referral to the NSW Quitline service n = 66; advised to speak to their GP, AMS or other health professional n = 124; *harmful alcohol consumption*: Total referral/follow-up: n = 155 (all advised to speak to their GP, AMS or other health professional); *inadequate fruit and/or vegetable consumption*: Total referral/follow-up: n = 799: advised about the NSW Get Healthy Coaching and Information service n = 321; offered a referral to the NSW Get Healthy Coaching and Information Service n = 75; advised to speak to their GP, AMS or other health professional n = 514; *inadequate physical activity*: total referral/follow-up: n = 407: advised about the NSW Get Healthy Coaching and Information service n = 142; offered a referral to the NSW Get Healthy Coaching and Information service n = 34; advised to speak to their GP, AMS or other health professional n = 210. Note: participants could have received more than one offer of referral/follow-up, hence numbers in each referral/follow-up do not add to total referral/follow-up.

^f Other care combinations were excluded from association analysis: n = 41 smoking (5.3% at-risk sample); n = 45 alcohol (3.5% at-risk sample); n = 483 fruit and/or vegetable consumption (12.0% at-risk sample); n = 156 physical inactivity (11.8% at-risk sample).

identified associations are strengthened for participants who enact referrals and/or recommendations, in order to fully understand the impact of referral/follow-up.

The finding that receipt of assessment only is associated with reported behaviour change for fruit and/or vegetable consumption and physical activity, and receipt of assessment and advice is associated with reported behaviour change for all behaviours except smoking, differs from research suggesting that more intensive elements (assist, arrange/referral/follow-up) are required for successful behaviour change (Gordon et al., 2010; Park et al., 2015; Whitlock et al., 2004). This may be explained by the short length of follow up examined, with previous studies exploring the impact over longer term follow-up periods of between 6 (Whitlock et al., 2004) and 12 months (Gordon et al., 2010; Park et al., 2015; Whitlock et al., 2004). The current study explored short-term behaviour change over approximately one month. It is possible that the provision of less intensive elements of preventive care (assessment and advice) increase the likelihood of short term behaviour change, but that longer term sustained changes require more intensive support. This is supported by studies of clinician provided counselling interventions where brief behaviour change advice led to small, short term improvements in behavioural risks (Whatnall et al., 2018), but where more intensive advice and counselling interventions led to larger effect sizes (Lancaster and Stead, 2017; Rees et al., 2013) and longer term sustained behaviour change (Whitlock et al., 2002; Lancaster and Stead, 2017; Rees et al., 2013; Stead et al., 2013; Werch et al., 2006).

In the current study, among participants who were at risk, between 18% (of smokers) and 51% (of those consuming inadequate fruit and/or vegetables) did not receive any preventive care. Despite its brevity, research has found that the provision of AAR is low in all types of

healthcare services including general practice, obstetrics, and community health, mental health, and drug and alcohol services, with the provision of referral particularly low (McElwaine et al., 2013; McElwaine et al., 2014a; Bartlem et al., 2015; Bartlem et al., 2014; Tremain et al., 2016; Zeev et al., 2017). Most studies that have evaluated the implementation of preventive care models into healthcare settings have focused on the 5As (Harris et al., 2013; McElwaine et al., 2016; Carroll et al., 2016; Martínez et al., 2017; Washington et al., 2017), with few exploring strategies required to implement the briefer AAR model into routine care (Wiggers et al., 2017; McElwaine et al., 2014b; Patwardhan and Cheung, 2012; Simerson and Hackbarth, 2018). The larger trial from which the data for the current study was obtained involved a comprehensive practice change intervention that increased the provision of assessment and advice in community health services, but not referrals (Wiggers et al., 2017). Given the potential impact of routine provision of AAR on population level behaviour change, future research should focus on understanding the strategies required to support the implementation of this preventive care model. Additional strategies to support clinicians to provide referrals to ongoing behaviour change supports, such as electronic referral processes and use of technology, and improved referral pathways (Vidrine et al., 2013; Krist et al., 2008; Adsit et al., 2014; Sherman et al., 2008), are likely required.

The results should be interpreted in light of a number of methodological limitations. The design allowed for association analyses only, and therefore it is not possible to attribute causality in behaviour change to the receipt of preventive care. Furthermore, receipt of preventive care and previous engagement in health risk behaviours was reported retrospectively and subject to recall and social desirability response bias, and it is possible that those who changed their

Table 3
Receipt of care, and association with change in risk status ^a.

Care received	% (n) who changed risk ^b	N	Odds ratio ^c	95% CI	Other pairwise comparisons between categories ^{**}	Odds ratio	95% CI
<i>Tobacco smoking: n = 729</i>							
No care	7.2% (10)	138	1				
Assessment	7.1% (6)	85	0.957	0.335–2.736	(Ass + Adv) / Ass	1.225	0.462–3.248
Assessment + advice	8.5% (16)	188	1.172	0.515–2.669	(Ass + Adv + Ref) / Ass	2.534	1.048–6.124
Assessment, advice, referral/follow-up	16.3% (52)	318	2.425	1.192–4.933	(Ass + Adv + Ref) / (Ass + Adv)	2.069	1.143–3.745
<i>Harmful alcohol consumption: n = 1251</i>							
No care	10.6% (43)	404	1				
Assessment	14.6% (68)	460	1.349	0.893–2.038	(Ass + Adv) / Ass	2.094	1.420–3.090
Assessment + advice	24.6% (66)	264	2.825	1.841–4.334	(Ass + Adv + Ref) / Ass	1.495	0.891–2.507
Assessment, advice, referral/follow-up	20.3% (25)	123	2.016	1.164–3.493	(Ass + Adv + Ref) / (Ass + Adv)	0.714	0.420–1.212
<i>Inadequate fruit and/or vegetable consumption: n = 3558</i>							
No care	3.4% (71)	2045	1				
Assessment	8.1% (40)	496	2.398	1.601–3.594	(Ass + Adv) / Ass	1.070	0.683–1.675
Assessment + advice	8.4% (45)	536	2.565	1.737–3.788	(Ass + Adv + Ref) / Ass	1.738	1.140–2.648
Assessment, advice, referral/follow-up	13.3% (65)	481	4.167	2.914–5.960	(Ass + Adv + Ref) / (Ass + Adv)	1.625	1.082–2.439
<i>Inadequate physical activity: n = 1172</i>							
No care	16.1% (67)	410	1				
Assessment	34.9% (69)	195	2.805	1.889–4.165	(Ass + Adv) / Ass	0.826	0.557–1.224
Assessment + advice	30.7% (82)	267	2.316	1.599–3.354	(Ass + Adv + Ref) / Ass	1.023	0.701–1.494
Assessment, advice, referral/follow-up	35.7% (107)	300	2.869	2.013–4.090	(Ass + Adv + Ref) / (Ass + Adv)	1.239	0.871–1.762

^a Alcohol overconsumption model adjusted for gender and Aboriginal and/or Torres Strait Islander origin; inadequate nutrition model adjusted for education level; no significant covariates were found for smoking and physical inactivity models.

^b Indicates a change in risk status, from being at risk (pre) to no longer being at risk (post).

^c Reference category is no care.

^{**} Reference category is the denominator Ass = assessment; Adv = advice; Ref = referral/follow-up.

behaviours were more likely to remember receiving preventive care. The study included only a small sample of smokers and did not examine level of alcohol dependence or abuse; and the short follow-up period does not allow for the exploration of longer term sustained impacts on behaviour change. Finally, the study was limited to clients of community health services within one local health district in Australia. Though the sample is reflective of the primarily regional geographical profile of the health district and the older population who access community health, the extent to which findings generalise to other locations or client types is unknown.

5. Conclusion

Despite limitations, the study suggests that the receipt of any preventive care may be beneficial, though the full AAR model is associated with the greatest odds of behaviour change across all four behaviours. There is a need to explore the impact of variable levels of care receipt on longer term behaviour change with a more rigorous study design to fully understand the benefits of this approach. Future research should focus on exploring how to successfully implement the AAR model of preventive care into routine healthcare provision.

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Authors' contributions

All authors provided substantial contribution to the conception and design of the study and interpretation of the data. All authors provided substantial contribution to drafting and revising of the manuscript and gave final approval of the version to be published. Authors KB and KC contributed to the analysis of data.

Ethics approval and consent to participate

Ethical approval was obtained from the Hunter New England Human Research Ethics Committee (approval No. 09/06/17/4.03) and University of Newcastle Human Research Ethics Committee (approval No. H-2010-1116).

Competing interests

The authors declare that they have no competing interests.

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